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Retirement Behaviour and the CPP: A Simulation Model

by

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ABSTRACT

There is a growing concern that the ratio of workers to non-workers in Canada will likely fall dramatically as a result of a demographic trend towards an older population and a labour force trend towards earlier retirement. The high proportion of non-workers may place increasing pressure on government finances, if non-workers use public services more intensively and generate less in tax revenue than workers, as is often assumed. This concern has led many to question the public sector's influence on retirement behaviour.

This paper provides estimates of the effects of modifications to the Canada Pension Plan (CPP) on retirement behaviour using a dynamic simulation model. We show how various changes in the structure of benefits and contributions can alter the age at which individuals choose to retire. Specifically, we find that eliminating the requirement that individuals retire in order to claim CPP benefits could increase the retirement age.

RÉSUMÉ

Il existe de plus en plus d'inquiétude face au déclin potentiel du ratio du nombre de travailleurs et du nombre de personnes ne travaillant pas suite aux changements démographiques impliquant une population vieillissante jumelée à une hausse de la tendance à la retraite anticipée. La forte proportion de personnes ne travaillant pas peut causer de plus en plus de pressions sur les finances gouvernementales si les personnes non au travail font un usage plus intensif des services publics mais génèrèrent moins de recettes fiscales comme c'est souvent supposé. Cette préoccupation a poussé plusieurs personnes à questionner l'influence du secteur public sur le comportement à l'égard de la retraite.

Ce travail présente des estimations sur les effets des modifications au Régime de pension du Canada (RPC) sur le comportement à l'égard de la retraite à l'aide d'un modèle dynamique de simulation. Nous présentons dans quelle mesure divers changements dans la structure des bénéfices et des contributions peuvent changer l'âge auquel un individu décide de prendre sa retraite. Plus particulièrement, nous trouvons que l'élimination de l'exigence du départ à la retraite pour réclamer les bénéfices du RPC pourrait hausser l'âge de la retraite.

I. Introduction

Over the next few decades the worker to non-worker ratio in Canada is expected to fall dramatically, a result of a demographic trend towards an older population and a labour force trend towards earlier retirement. The high proportion of non-workers may place increasing pressure on government finances. These forecasts have led many to ask whether government income programs are influencing the retirement decision.

In this paper we focus on one aspect of Canada's retirement income program—the Canada Pension Plan (CPP)—and ask how adjustments to the CPP may affect the age of retirement using a life-cycle-simulation model.

The CPP is a public, defined benefit pension plan. Benefit entitlements depend on the number of contributory years in the program and the level of contributions. Individuals can choose to begin receiving benefits as early as age 60 or as late as age 70, subject to actuarial adjustments. In theory, an individual must retire from employment in order to claim benefits if he is younger than 65, but can then re-enter the workforce without penalty. Alterations to the CPP may affect retirement in two ways:

1. *Substitution Effect:* Benefits change the relative costs of consumption and leisure. Holding all else constant, an increase in CPP benefits makes leisure less expensive and thus retirement becomes more attractive. The substitution effect is only relevant if individuals must give up wages to get benefits.
2. *Wealth Effect:* An increase in CPP benefits raises an individual's lifetime wealth. If leisure is a normal good, then those with more lifetime wealth (higher expected benefits) would retire earlier.

Both effects are incorporated in the life-cycle model. The initial model uses the institutional features of the 2002 CPP program and is calibrated to the results found in Compton (2001). We then consider a combination of program adjustments: adjusting the actuarial formula so that early retirement benefits are less generous, removing the stop work requirement for CPP take-up, as well as charging CPP premiums until retirement. We provide some illustrative projections of the effect of these changes on retirement age.

Following the Introduction, Section II provides a conceptual framework, outlining a general model of retirement in a life-cycle framework and describing the details of Canada's retirement income system. Section III outlines the parameter assumptions and numerical calibration. Finally, the results of the simulations are presented in Section IV, followed by a conclusion.

II. Conceptual Overview

The model we use to examine retirement decisions is a straightforward life-cycle model based on Samwick (1998). It is important to note that this model is derived from a lifecycle framework without credit constraints or bequest motives.[1] We assume that an individual's preferences for consumption c and leisure ℓ are given by the utility function

$$V = \int_0^T e^{-\rho t} \cdot u(c(t), \ell(t)) \cdot dt \qquad (1)$$

where ρ denotes the individual's subjective discount rate, and T is the date of death, known with certainty.[2] Leisure is assumed to take on one of only two values: ℓ^{work} while the individual is working; and ℓ^{ret} once the individual has retired. The individual's problem is to choose a consumption stream $\{c(t)\}_0^T$ and a retirement date R to maximize utility subject to the intertemporal budget constraint

$$\int_0^T e^{-rt} \cdot c(t) \cdot dt \le A(0) + \int_0^R e^{-rt} \cdot w(t) \cdot (1-\tau) \cdot dt + \int_R^T e^{-rt} \cdot b(R) \cdot dt\,. \qquad (2)$$

In this expression, r is the real interest rate, $A(0)$ is the initial level of wealth, $w(t)$ is the after-tax wage rate, and τ is the contribution rate. $A(0)$ can also be thought of as including the net present value of all benefits that are not contingent on the retirement decision such as Old Age Security and the Guaranteed Income Supplement. $b(R)$ is the level of those retirement benefits that depend on the date of retirement.

A key feature of this model, unlike a standard dynamic optimization model in which an individual can alter his work effort in each period, is that the only way that the individual can alter the amount of leisure that he or she enjoys is by retiring earlier or later. A continuous choice set of values would imply that individuals are able to choose the exact

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[1] Borrowing constraints would likely lead low income, credit constrained, individuals to be more responsive to changes in the CPP since they could not borrow against OAS and GIS between their retirement age (60) and the age at which these benefits begin (65). Bequest motives, on the other hand, could be modelled in one of two ways: either through a bequest motive or accidental bequests due to uncertainty with respect to mortality. Given the apparent lack of support for the Ricardian equivalence hypothesis and the fact that agents in our model know the length of their lives with certainty, we do not consider either method. These are simplifying assumptions that will influence the results, but we leave the task of estimating the importance of using a lifecycle model for the results to future research.

[2] This assumption is arguably important to the retirement decision. However, it would have no importance if individuals have access to actuarially fair annuity markets. In these simple models, accounting for uncertainty generally yields the counter-intuitive result whereby very old seniors simply consume out of government-sponsored retirement income transfers since they have already drawn down their private savings due to the very low probability of surviving to such old age. In reality, seniors tend to hold a great deal of wealth—generally in the form of housing wealth—well into old age. This represents a major hurdle in the literature that requires a great deal of attention and will not be addressed further in this paper.

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hours that they will work during the year, a level of flexibility that is rarely observed in practice. Instead, individuals choose to either work full-time or retire.[3]

An important difference between theory and practice results from this assumption, however. As noted in the first section of this paper, individuals are able to return to employment after claiming CPP, as long as they first exit the labour market. In this model, however, individuals must fully and permanently retire before claiming CPP. This assumption is defensible, however, given that the fraction of retirees who return to full employment for a significant amount of time, having claimed CPP, is quite low even though some individuals continue to work after claiming CPP.[4] Nonetheless, in Appendix 2 we show that this assumption does not have a major effect on the results unless we assume that a very significant fraction of individuals are not affected by the work test.

The first order conditions for this problem with respect to consumption and the retirement date imply that

$$u_c\left(c(t), \ell(t)\right) = \lambda \cdot e^{(\rho - r)t} \tag{3}$$

$$e^{-\rho R} \cdot \left[u(c^{ret}, \ell^{ret}) - u(c^{wkg}, \ell^{wkg})\right] = \lambda \cdot e^{-rR} \cdot \left[w(1-\tau) - b(R) + \int_R^T e^{-r(s-R)} \cdot \frac{\partial b(R)}{\partial R} \cdot ds\right] \tag{4}$$

where c^{ret} and c^{wkg} are the values of consumption at and immediately before retirement. This expression says that the discounted increase in utility from retirement owing to greater leisure must be equal to the utility value of the discounted loss in income from retiring. The latter equation can be divided into two parts. First there is the immediate financial cost of retiring at R, given by $w \cdot (1-\tau) - b(R)$, and second there is the impact of retiring now on future benefits, which is the last term in the square brackets.

Changes to retirement benefits will have two separate effects in this model. The first is the *substitution effect*, which comes from changes in the relative price of leisure, given by the term in square brackets on the right-hand side of (4). Increases in benefits that are tied to the cessation of work will reduce the returns to working and so reduce the relative price of leisure. On the other hand, if the pension system provides higher benefits for those who delay retirement (the last term in square brackets) this will increase the returns to working and so raise the price of leisure. The second effect is the *wealth effect*, which acts through the budget constraint (Equation 2). Any policy change that increases an agent's wealth will allow the agent to buy more leisure, assuming leisure is a normal good, and so reduce the age of retirement.

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[3] Demand-side constraints on labour market choice are not included in the model.

[4] Compton (2001) estimated that only about 5 per cent of new male CPP claimants returned to work after retirement and over 60 per cent were fully retired by the time they claimed CPP.

Taking each of our simulated policy changes one at a time, we can consider the resulting wealth and substitution effects on retirement age.

Work Test:

In our simulations, the work test requires that individuals under the age of 65 fully retire before they can collect CPP benefits. This means that the relative price of retiring—the difference between pre-retirement and retirement income—includes CPP benefits. Eliminating this requirement will have both a substitution and a wealth effect. The substitution effect arises due to the fact that the retirement decision is no longer tied to the decision to claim CPP and hence, the relative price of retiring has increased—it no longer includes the CPP benefits. This substitution effect will induce an incentive for individuals to delay retirement.

On the other hand, removing the work test means that CPP benefits are no longer tied to the retirement decision. Therefore, the age at which people claim CPP is chosen only to maximise lifetime income, since it is no longer constrained by retirement age. Therefore, lifetime income (for any given retirement age) will not fall as a result of removing the work test but may increase, leading to a wealth effect that works against the substitution effect described above. The net effect is again theoretically ambiguous.

Pay Premium until Retirement:

Currently, individuals contribute to the CPP until they claim it, whether they are retired or not. We consider the option of requiring individuals to contribute until they retire, whether they have claimed CPP or not. It is important to note that this option will have no effect in our simulations unless the work test is also removed, since the age at which individuals retire is identical to the age at which they claim CPP when the work test is in place for those who retire before age 65. If the work test is removed, however, individuals who claim CPP before retiring will experience both a substitution effect and a wealth effect as a result of requiring them to continue to contribute until they retire.

The substitution effect arises since net pre-retirement income has fallen for those who claim CPP before retiring. This results in an incentive to retire earlier since the relative price of retiring is lower. On the other hand, the wealth effect of this policy change results from the fact that lifetime income is lower for a given retirement age and leads to an incentive to delay retirement.

Actuarial Adjustment:

Any change in the actuarial formula, which determines the level of CPP benefits conditional on the age of retirement, will also have both a wealth and a substitution effect on the age of retirement.

The substitution effect arises since changes to the actuarial formula changes the benefits of continuing to work through a decrease in the relative price of leisure. This means that

any increase in the rate at which benefits increase with retirement age will cause an incentive to delay retirement through the substitution effect.

If on the other hand, benefits are more generous for a given retirement age after the change in the actuarial adjustment, then the increased lifetime wealth allows individuals to purchase more leisure by retiring earlier. Our actuarial adjustment reduces benefits for those who retire before age 65 and increases them for those who retire after age 65. Therefore, the wealth effect increases retirement age for those who retire before 65 and reduces it for those who retire after age 65.[5]

Discussion:

An important consideration to keep in mind when assessing a policy change is that in simple models such as this one where there is a fixed, risk-free interest rate and no credit market imperfections, policy changes that increase contribution rates early in an agent's life in order to increase benefits later on will only have a wealth effect if they raise the overall *lifetime* wealth of the agent. Thus there must be some kind of redistribution that is not captured in our single-agent model, either from people of the current generation, or from other generations, if the wealth effect is to operate. However, because there will then be a negative wealth effect on these other agents, the *net* long-run effect of the policy change will depend upon which group is the most sensitive to changes in wealth.

[5] Specifically, the new factors would be lower than the base case factors up to age 65. In practice, this means that someone retiring at age 60, who would have received $3343 in retirement benefits before the change, now receives $3056. The wealth effect is due to the fact that retirement benefits are lower, whereas the substitution effect result from the fact that delaying retirement is now more attractive since the difference in benefits for retiring at age 61 rather than 60 is higher than in the base case. The benefits would grow by more than 9 per cent for every year that retirement is delayed rather that the assumed average of about 6.5 per cent per year.

III. Numerical Implementation

Although the model described in the previous section is conceptually straightforward, closed form solutions are difficult to calculate given the complicated structure of Canada's tax and benefit system. We therefore solve the model numerically using a discrete time approximation.

We wish the simulation model to match certain features of actual retirement behaviour in Canada, and so certain parameters and variables are kept free so that our model may match these features. The key target variable is the average age of retirement, conditional on the wage rate. Information on the average age of retirement is obtained from Compton (2001). This version of the model has detailed information on the tax structure for single males residing in Ontario in 2001.

Functional Forms

The utility function is of the Stone-Geary form, modified to allow for a non-unitary elasticity of intertemporal substitution:

$$u(c_t,\ell_t)=\begin{cases}\dfrac{\sigma}{\sigma-1}\left[(c_t-c_{\min})^{\theta}(\ell_t-\ell_{\min})^{1-\theta}\right]^{\frac{\sigma-1}{\sigma}}, \sigma>0, \sigma\neq 1; \\ \ln\left[(c_t-c_{\min})^{\theta}(\ell_t-\ell_{\min})^{1-\theta}\right] \qquad \sigma=1.\end{cases} \tag{5}$$

This functional form was chosen for tractability. The symbol ρ denotes the individual's subjective discount rate, θ is a parameter that governs the relative importance of consumption and leisure in generating utility and σ is the intertemporal elasticity of substitution in consumption (IES). The coefficient of relative risk aversion is equal to the reciprocal of the intertemporal elasticity of substitution for this functional form. Intuitively, the larger is σ, the more concave is the utility function, the greater will be the desire of the individual to equalize utility across time, rather than move it around in response to changes in interest rates.

Model Parameters

The variables in the simulation model can be separated into two groups: those based on *a priori* assumptions and those whose values are chosen to ensure that the results are consistent with the data. The latter group includes only the variable for the relative weight of consumption in utility.

a) Parameters fixed a priori

Aggregate Economic Variables

Variable	***Symbol***	***Value***
Real interest rate	r	0.04
Rate of growth of real wages	g	0.011

The real interest rate and the rate of growth of real wages were set to be consistent with the projections made in the latest actuarial report on the Canada Pension Plan (OSFI 2001).

Preference Parameters

Variable	***Symbol***	***Value***
Subjective Discount Rate	ρ	0.018
Elasticity of Intertemporal Substitution	σ	0.33

Consistent with estimates by Attanasio and Weber (1995), we set the value of the IES at 0.33 for all education groups. This is consistent with a coefficient of relative risk aversion of 3, which is in turn, consistent with the commonly found result that consumers are averse to the risk of experiencing a period with low consumption.

Leisure Time Variables

Time variables are based on a normalization of the hours spent in full-time work. We assume that the hours spent working full-time is equal to 1. Consider the other time variables on a weekly basis. If full-time working hours equal forty hours per week and are normalized to 1, the total time available in a week is equal to 4.2 (168 hours per week /40)). We assume that the minimum leisure hours required is simply the time spent in sleep, 8 hours per day. Thus the ℓ_{min} variable is equal to 1.4 (56 sleeping hours *(1/40)).

Time Variable	***Symbol***	***Value***
Total Time Available	ℓ_{max}	4.2
Minimum Leisure Time	ℓ_{min}	1.4

b) Parameters Chosen by Calibration

We use a single preference parameter for leisure, forcing the difference in wage paths to account for differences in retirement ages between earnings groups. The relative weight

of leisure in utility, $(1-\theta)$, is set to 0.71. This provides us with retirement ages that are very close to those we observe in the data across different earnings profiles—60 for the lower wage profiles and 62 for the higher profiles.

Parameter	***Symbol***	***Value in Base Case***
Relative Weight of Leisure	$1-\theta$	0.71

The Wage Path

Ideally, we would calculate lifetime consumption profiles and retirement ages for every cohort affected by the policy changes using their actual and projected lifetime income profiles—including an imputed wage that would have been earned if they had chosen to work until death. However, for both simplicity and efficiency, we chose to assume that there are 5 different types of individuals, distinguished by their lifetime income profiles.

The lowest wage profile is constructed by calculating the earnings of someone working full-year full-time at minimum wage. This profile is then augmented by a 0.5 per cent productivity rate, anchored at age 44. The result is a very flat wage profile that grows at below the average growth in labour productivity of 1.1 per cent assumed in the rest of the model. The other four wage paths are constructed as convex combinations of the minimum and a 95th per centile wage profile, estimated using data from the 1981 to 1997 individual files of the Survey of Consumer Finance.

The estimated wage path of the 95th percentile is conditional on full-year full-time employment, and is estimated using data on men living in Ontario. The wage profiles were estimated by regressing the logarithm of earnings on a quadratic in age, and a set of year dummy variables allowing for growth in the cross-sectional profiles. Two adjustments are made to the estimated wage path. First, because the sample of wage earners over the age of 64 is too small to provide reliable wage estimates, we fit the model only to those aged 21 to 64, and then predict the wages for those 65 to 80 based on the estimated equation. Secondly, we add a 1.1 per cent productivity measure, anchored at age 44, to the estimated cross-sectional wage path such that $\widetilde{W}_t = W_t \cdot \left(1/1.011^{44-age}\right)$. The resulting average wage paths for males are shown in Figure 1.

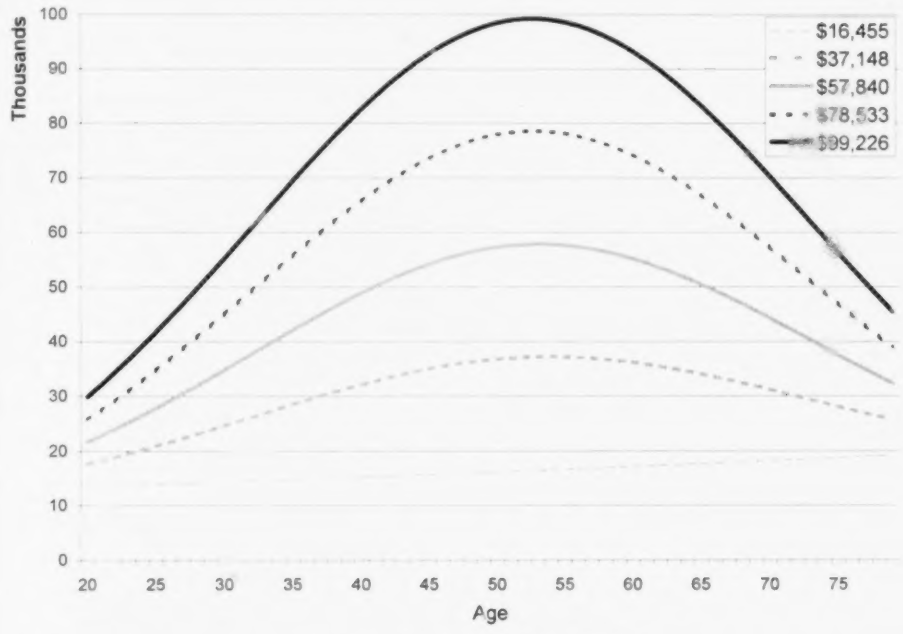

Figure 1: Wage Profiles

The peaks of the wage profiles account for a large proportion of working males in Ontario. Figure 2 shows both a frequency and cumulative income distribution of Ontario Males between age 40 and 50. The data were drawn from the 1998 person file of the Survey of Labour and Income Dynamics. Earnings for Ontario males include earnings from both paid-work and from self-employment. The distribution in Figure 2 excludes males with non-positive earnings, which does not significantly alter the qualitative results.

The only group that is not well-represented in our wage profiles is group 3. As can be seen, however, our wage profiles still account for almost 80 per cent of the relevant income distribution.

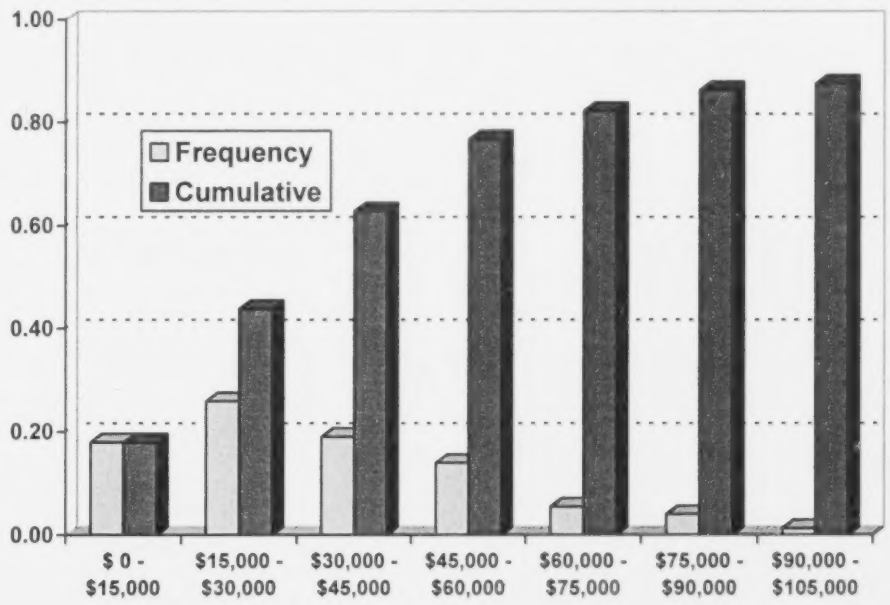

Figure 2: Income Distribution (Ontario Males, Age 40-50, 1998)

Since we do not include health constraints or a changing preference for leisure in the model, the expected wage decline around age 55 may be seen as capturing these effects. Health constraints would directly affect the annual wage that one could expect to receive in the market. Changing leisure preferences may affect the type of jobs one is willing to accept at this age and in turn may affect the wage available.

Institutional Structure

a) Tax System

The tax system imposed is the 2002 Ontario tax system as applied to a non-married male. We make no assumptions concerning the direction of fiscal policies.

b) Interest Income

The current version of the model does not allow for deferred taxation of savings or taxation of interest income. Saving should therefore be thought of as involving the acquisition of non-taxed assets such as housing. Future versions of the model could involve more detail in the tax treatment of savings.

c) CPP contribution rate

We have maintained constant CPP contribution rates across the lifetime of the individual at a combined employee and employer rate of 9.9 per cent of insurable earnings, with both employer and employee each contributing half of the premium. Thus, workers face a 4.95 per cent contribution rate. It is, however, important to note that the distribution of contributions between employer and employee is not particularly important in the long run since wages and employment adjust until the distribution of the tax is satisfactory to both employers and employees. If, for example, labour is supplied inelastically, employees will always bear 100 per cent of any payroll tax (even if 100 per cent of the tax is collected from employers).

d) Private Pension Schemes

The model used in this paper does not account for private pensions, and does not, therefore account for their possible influence on retirement behaviour. This is admittedly very important for our quantitative results since changes in the CPP may have less affect on retirement ages than is predicted by the model if private pensions impose and continue to impose significant incentives for early retirement. While this may be important to the exact results, the relative size and direction of the affects of each of the policy scenarios is not likely to be affected by accounting for the effect of private pensions on retirement ages.

IV. Results

Results for the base case scenario – Current CPP system

The base case results use the estimated wage paths for males described above. Given our parametric and institutional assumptions, the resulting retirement ages for men in the base case are between 60, for the lowest income earners, and about 62 for the highest. Figure 3 shows the resulting sources and levels of earned and pension income while Figure 4 shows the total after-tax income and resulting consumption profile. Both Figure 3 and Figure four are drawn for an individual whose peak total earnings are $37,148.

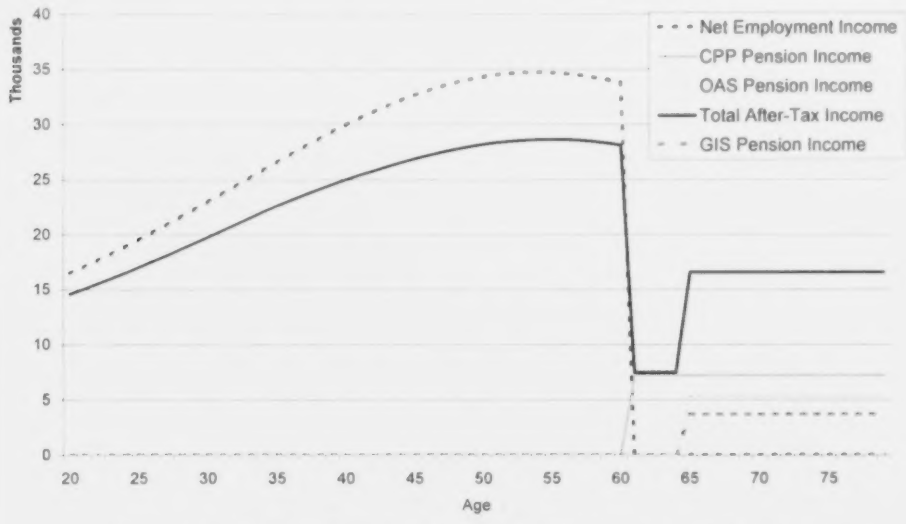

Figure 3: Lifetime Income Sources—Employment and Pension

In a model with perfect capital markets, a single lending and borrowing rate, a completely flexible labour market—wherein individuals can choose any number of hours to work—, perfect annuity markets, and a subjective discount rate equal to the interest rate, the optimal consumption path would be flat. The reason is that individuals have a preference to maintain a smooth profile of consumption and leisure in order to equalize their marginal utility across periods.

The strength of this preference is determined *inter alia* by the value of the EIS, and the relative weight of leisure in the utility function. If the EIS were set at 1, then the individual would have no preference for maintaining a smooth profile of marginal utility and would accept any increase in leisure with no change in consumption. With a value of

the EIS less than one, however, the individual wishes to maintain some constancy of marginal utility across periods, and will substitute some consumption for leisure freely. The exact amount of consumption that is exchanged for leisure will then depend on the relative weight given to leisure in the utility function.

We deviate from the simple model in two significant ways. First, the subjective discount rate is lower than the interest rate, meaning that individuals are more patient than the capital market. As a result, individuals are willing to delay some consumption in order to benefit from the interest that they incur at a later date. This is the reason for the positive slope of the consumption profile.

Next, we have modelled the labour supply decision as dichotomous—individuals are either in full-time employment or are fully retired. Therefore, when the individual retires, he suddenly has much more leisure time, lowering the marginal utility of consumption. In retirement, therefore, leisure substitutes for some consumption meaning that a retiree is willing to accept marginally lower consumption as a result of having more leisure time. This is the cause of the sudden reduction in consumption at retirement.[6]

This may appear at odds with work that has shown that Canadians do not experience sudden drops in *standard of living* in retirement, however, it is important to note that consumption is not the only source of welfare in our model.[7] In fact, our model predicts that, in retirement, individuals purchase more leisure and less consumption, thereby avoiding any sudden reduction in *standard of living*, suggesting that the sudden reduction in consumption predicted in this model is not at odds with previous work.

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[6] This is often observed in actual consumption data. See Hamermesh (1984) for an example.

[7] See Lise (2002) for an example.

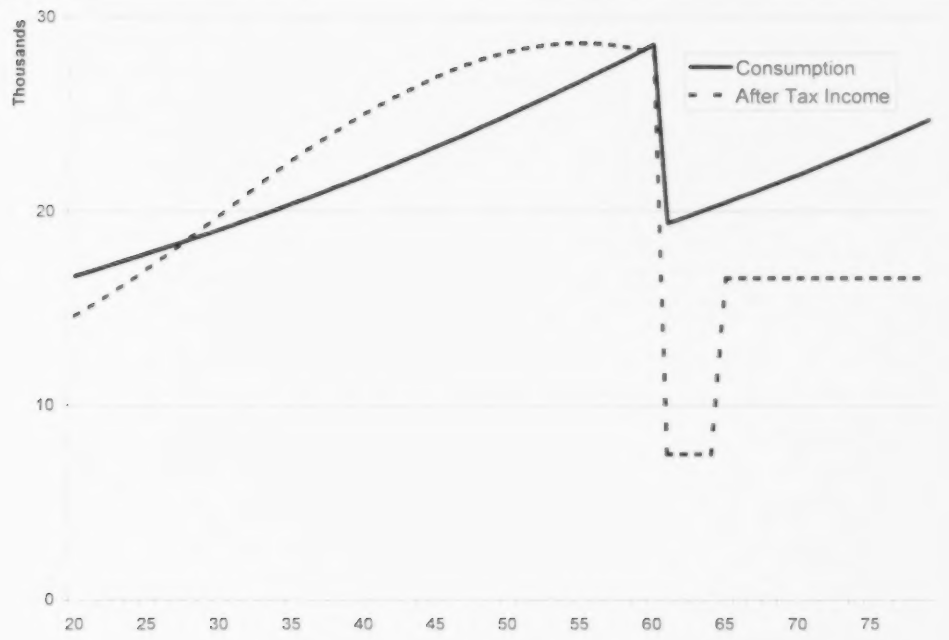


Figure 4: Lifetime Income and Consumption Profiles

The individual accumulates savings while working in order to finance consumption expenditures during the years when his employment income falls, and to account for the fact that the interest rate that he faces on savings exceeds his subjective discount rate.

Table 1 presents the retirement ages that result from the policy simulations described above for each of the five wage profiles.[8] As mentioned above, the retirement ages for the Base Case (1.a) match the pattern we see in the data—retirement ages of 60 for those with lower wage profiles and of about 62 for those with higher wage profiles. In the base case, CPP take-up and retirement occur at the same age.

The weighted average column in Table 1 is a summary measure created by weighting each of the income groups by the fraction of the population that it represents. The data and methods used to calculate the population weights is the same as in figure 2, but the income cut off points occur at \$0; \$20,703; \$41,395; \$62,088; and \$82,781.

Finally, Figure 5 shows the consumption profiles for each of our five income groups for the 90 per cent of Base Case that is bound by the work test. Both the slope of and discontinuity in the consumption profile can be clearly seen in each of the income

[8] The simulated age at which individuals claim CPP payments is presented in the appendix.

groups' consumption profiles. In the following section, we discuss the simulated retirement ages under each of the scenarios, in succession.

Table 1: Retirement Ages

		(I)	(II)	(III)	(IV)	(V)	Weighted Average
	Peak Earnings (Age 53)	**$16,445**	**$37,148**	**$57,840**	**$78,533**	**$99,226**	
	Earnings Growth to Peak	0.50%	2.23%	2.96%	3.38%	3.65%	
1.a	**Base Case**	60	61	61	61	62	60.94
1.b	**Base Case—No Work Test**	60	63	64	65	65	63.33
2.a	**Actuarial Adjustment**	60	61	62	62	62	61.37
2.b	**Actuarial –No Work Test**	60	63	65	65	65	63.59
4	**Pay Premium until Retirement**	60	61	61	61	62	60.94
5	**Premium to Retire—No Work test**	60	61	63	64	64	62.16
6	**Premium to Retire, No Work test, Actuarial**	60	61	63	64	64	62.16

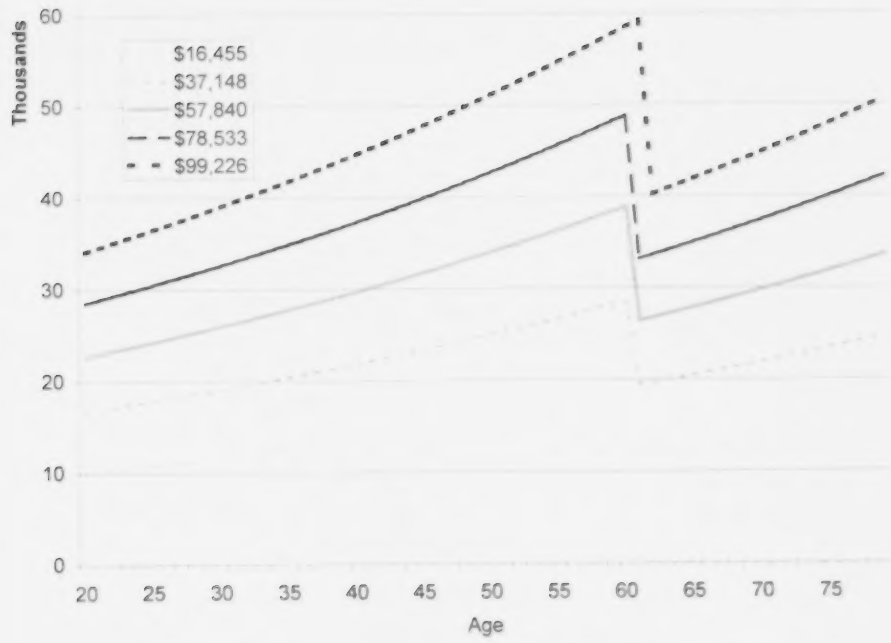


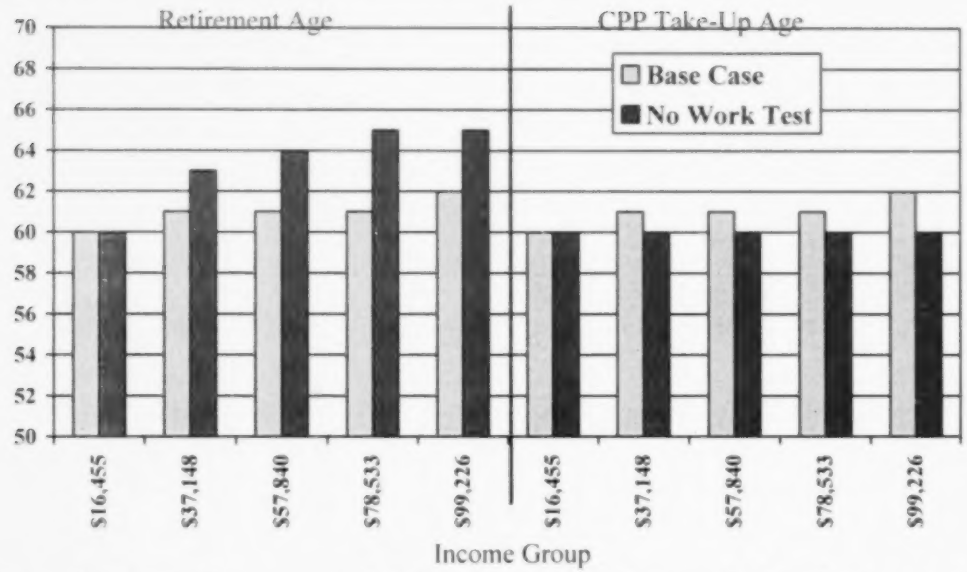
Figure 5: Consumption Paths (Base Case)

CPP Program Scenarios

As mentioned in the introduction, we are interested in modelling several possible adjustments to the current CPP program. The first is the elimination of the work test that requires a job separation in order to collect CPP benefits. The second is a change to the actuarial adjustment that makes early retirement less generous—closer to the adjustment that accounts for declining survival probabilities. The third combines the elimination of the work test requirement with actuarial adjustments and a requirement to continue to contribute to their CPP until their retirement, rather than until the date at which they begin to claim CPP benefits. Finally, we model various combinations of these scenarios.

Work Test:

Figure 6: No Work Test Versus Base Case

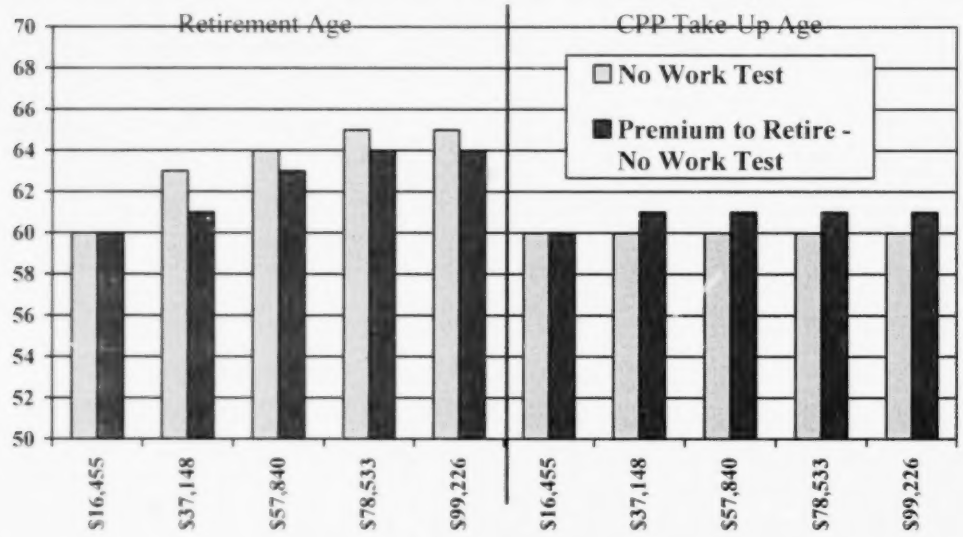


Removing the work test causes individuals to delay retirement for 2 to 3 years for the lowest wage profiles, and about 3 to 4 years for the highest. This is an increase in labour force participation for all but the lowest wage profile. In this case CPP benefits are collected at age 60, as soon as the individuals become eligible.

The increase in retirement ages is due to the substitution effect generated by the relative increase in the price of leisure. Since the work test forces most individuals to retire before they can collect CPP benefits, retirement is relatively inexpensive in the base case. Once the work test is removed, all individuals claim CPP at age 60 and retirement becomes relatively more expensive since the price that they face by retiring (ignoring OAS and GIS) is no longer the difference between earning wages and CPP benefits (as it is in the base case), but between wages and earning nothing.

Pay Premium until Retirement:

Figure 7: Pay Premium until Retirement (w/o Work Test) Versus No Work Test



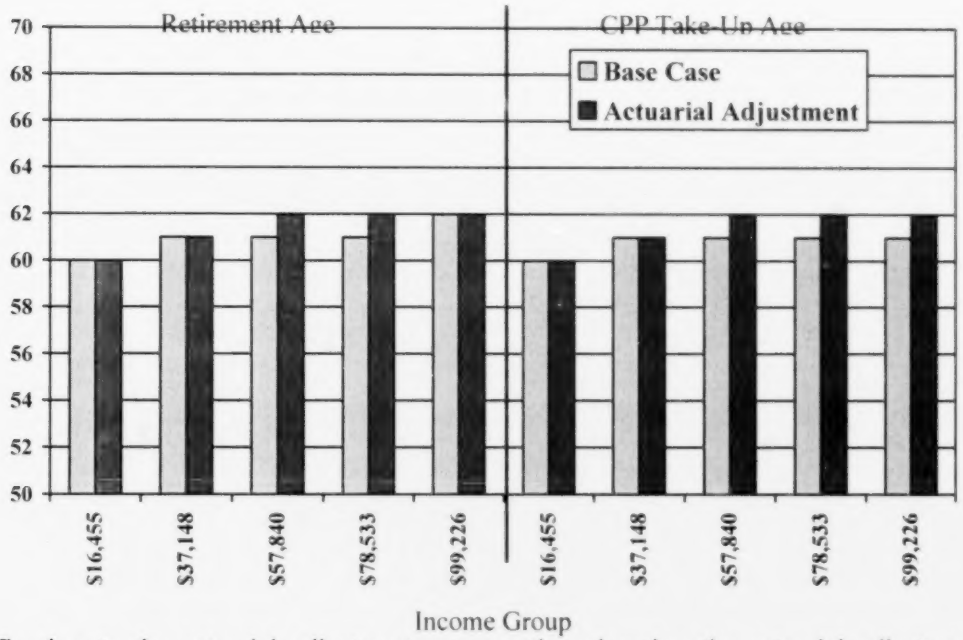
Requiring the payment of premiums until retirement only has an effect if the work test is removed. The reason is that individuals who are bound by a work test collect their CPP at the same age as they retire whether they are forced to pay premiums until retirement or not. Therefore, whether they pay until retirement or until the date at which they choose to claim CPP has no effect on their lifetime income profile and hence has neither an income nor a substitution effect on the retirement decision.

When this policy is combined with the removal of the work test requirement, however, we see that retirement age is reduced for each of the four middle-income groups when comparing with the simulation where the only change is the removal of the work test (Figure 9), but that retirement age is still higher than in the base case suggesting that charging premiums until retirement does not eliminate all of the retirement-delaying effects of removing the work test.

The reason that requiring individuals to pay premiums until they retire reduces the age of retirement relative to the case where only the work test is removed is that the relative price of retiring is lower. Without the policy change, individuals do not pay CPP premiums between the age at which they claim CPP and when they retire. After the change, however, the individual pays the premium until they retire, meaning that reduction in net employment income that occurs at retirement is lower than in the case where the individual is not required to pay premiums after collecting their benefits. Again, it is important to note that this has less of an effect on retirement age than the removal of the work test, alone.

Actuarial Adjustment:

Figure 8: Actuarial Adjustment Versus Base Case



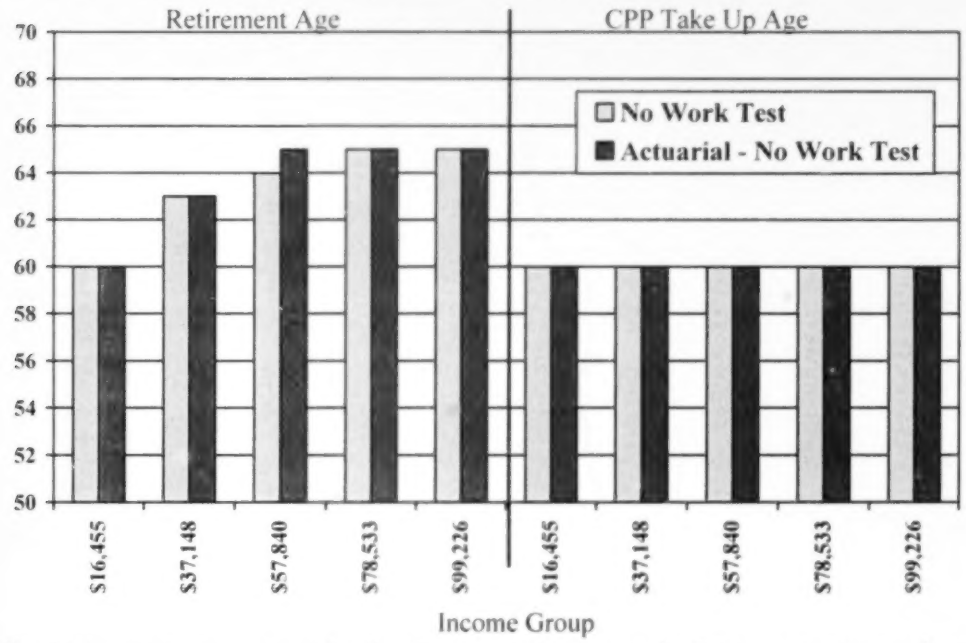
Turning to the actuarial adjustment, we see that changing the actuarial adjustment slightly to make early retirement less attractive has a weaker effect on retirement ages than removing the work test. In Figure 10, we can see that for wage path (III) and (IV) retirement is delayed by only one year and there is no change for the other paths.

The model predicts that individuals in both very low and very high-income groups do not alter their retirement ages in response to an increase in the actuarial factors. The reason is that the CPP does not represent a major source of income for either of the groups. High income individuals are generally unaffected because changes in the CPP have very little impact on their income relative to their total income, whereas the sum of OAS and GIS far outweighs CPP for low income individuals.[9]

Actuarial Adjustment Combined with Removal of the Work test:

[9] In fact, the low income individuals claim CPP and retire at age 60 in all of our simulations since they are able to borrow against their OAS and GIS benefits which begin at age 65 in order to maintain pre-retirement standard of living between age 60 and 65. This result depends critically on the fact that there are no borrowing constraints in the model. In reality, low income individuals are not likely able to borrow against OAS and GIS and would, therefore, be more responsive to changes in CPP benefits.

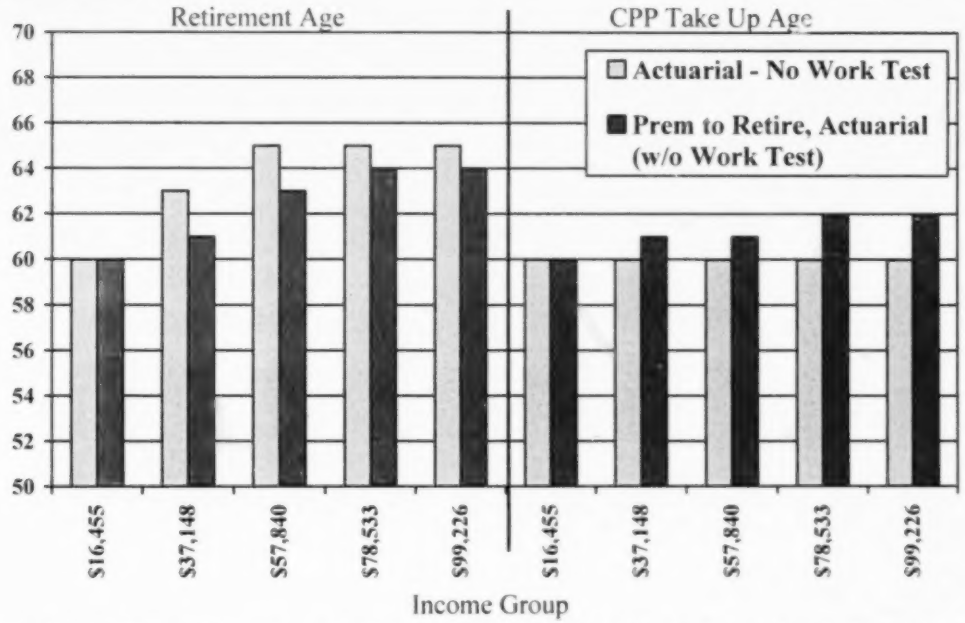
Figure 9: Actuarial Adjustment (w/o Work Test) Versus No Work Test



Combining both the actuarial adjustment and the removal of the work test results in almost the same retirement ages as simply removing the work test requirement. This indicates that the removal of the work test requirement dominates small changes to the actuarial adjustment. This is helpful to know, as it is extremely difficult to find the correct actuarial adjustment that properly accounts for changing survival probabilities. Survival probabilities are not only related to age, but also change over time. This simulation suggests that the removal of the work test does more to increase labour force participation around retirement age than changes to the actuarial adjustment for early or delayed take-up of the CPP.

Actuarial Adjustment Combined with Removal of the Work test and Contributions until Retirement:

Figure 10: Pay Premium to Retirement, Actuarial (w/o Work Test) Versus Actuarial, no Work Test



Finally, in Figure 12, we see that requiring those who claim their pension before retiring to continue to contribute to the CPP until they retire causes those who have incomes in groups II and III to retire one year earlier and for those in groups IV and V to retire two years earlier—when the policy change is combined with the removal of the work test and an actuarial adjustment. As was the case above, this is the result of a small substitution effect caused by a reduction in the relative price of leisure at the time of retirement.

Discussion

The differences in retirement age between the policy simulations are largely attributable to the substitution effect arising from the removal of the work test. This means that the work test is influencing the price of leisure by enough to affect the labour supply decision. This suggests strong economic support for the removal of the work test.

Another reason for removing the work test, which will not show up in this model, relates to imperfect information. If people are not certain about the level of CPP benefits they will receive they may miscalculate the best age at which to retire. By allowing early take-up of CPP without requiring retirement, individuals will know with certainty the level of benefits they will receive and will be in a better position to make their final job separation decision.

Transitional Effects

All of the results presented above assume that each individual is aware of the changes, not only before they occur, but from the time that they are born. This is an unlikely assumption in practice since it would imply phasing-in the policy changes over many years and only applying such changes to cohorts born after the date of implementation—meaning that, every generation currently alive would be required to pay for any costs of the changes without receiving any direct benefits.

A more likely option is that changes would be applied to anyone not yet retired. In this case, the change in retirement age would depend on the age of the individual when the policy change takes place.

For example, someone who is 55 at the time of implementation would react quite differently than someone who is 25. Specifically, the 55 year old has less time to adjust their consumption and savings, and will therefore not adjust their retirement age by as much as the 25 year old.

If, for example, the work test were removed, then the closer an individual is to their base-case retirement age upon implementation, the less they will delay their retirement as a result of the change. Consider the illustrative case where there are two individuals, one who is 25 and the other who is 55 when the work test is removed. Both 25 and 55 year olds experience an unexpected increase in wealth due to the fact that they can now receive their pensions at any age after 60. As stated in the previous section, the substitution effect of the removal of the work test causes an increase in retirement age, but now the wealth effect has become stronger due to the fact that the individuals have saved in preparation for the base case retirement age. They both attempt to account for this new wealth by consuming more when the information arrives, but this increases the marginal utility of leisure, relative to consumption. Since he wishes to maintain a smooth lifetime profile of marginal utility, and because he has less time to adjust to the change, the 55 year old would retire at a younger age than the individual who is 25 at the time of implementation.

All of this is to say that while the results presented above provide a good indication of the long run implications of the policy changes for individual retirement ages, transitional effects of the any of the changes considered could be very important in aggregate and are heavily influenced by how the costs and benefits of the changes are distributed across generations.

Strength of the Work Test in the Base Case

Throughout the paper, we assume that all individuals are bound by the work test. More specifically, we assume that they must fully and permanently retire in order claim CPP benefits. In reality, the work test may not be as influential in the retirement decision as

we have assumed and many factors that are not captured in our model may play more significant roles.

Some individuals may retire before claiming CPP since they wish to retire before the age at which they are able to claim (60). Some may claim employment or disability insurance after a job separation in expectation that they will return to work, but subsequently decide to retire and claim CPP. Others' retirement decisions may be more heavily influenced by their private pension plan. Many others may simply have very limited information on the regulations with respect to claiming and may claim long after retiring as a result. Furthermore, many individuals may choose to return to the labour market after having claimed their CPP. The only influence of the work test in this case, is to cause a temporary job separation. Should the work test be less influential than we have assumed and the retirement transition patterns described above be widespread, then the affect of removing the work test on retirement behaviour will tend to be overestimated.

Using the 1998 Survey of Labour and Income Dynamics person file, we found that about 8 per cent of surveyed Ontario males claimed that they received CPP benefits as well as earned over $8,937.48 in wages and salaries—the maximum allowed earnings under the work cessation test—suggesting that the work cessation test may not be a binding constraint for all CPP claimants. Furthermore, CPP earnings and benefits data suggest that about 30 per cent of individuals who claimed CPP between the ages 61 and 64 had no pensionable earnings for at least 2 years before they claimed CPP retirement benefits, suggesting that they had already retired from the labour market before claiming CPP and that the work test was not an important factor in their retirement decision.

Since the two groups described above (those who leave the labour force before and those who retire after claiming CPP) are not necessarily mutually exclusive, we adjust our primary results by a wide range of values for the fraction of individuals who are not bound by the work test in the base case. Somewhat arbitrarily, we use 30 per cent as our lower bound, 50 per cent as our upper bound, and 40 per cent as our medium assumption of the fraction of individuals not bound by the work test in the base case.

Results in Appendix 2 have been adjusted to account by these figures. To do this, we simply created a weighted sum of the retirement ages for the relevant simulations from our primary results in Table 1. For example, the base case results in Table 1a are the weighted sum of base case results for individuals fully bound by a work test and those who are not, where the weights are 0.3 and 0.7, respectively. Similar calculations were made for both the "actuarial adjustment" and the "pay premium to retirement" simulations.

While the effect of removing the work test on retirement decision is smaller the larger is the fraction of the population that is not bound in the base case, the results are qualitatively unchanged in the sense that the work test still has the largest effect on

retirement ages out of all of the options. This can be seen in table 2 below, wherein we summarize our results using our medium assumption for the fraction of the population that is not bound by the work test in the base case.

Table 2: Sensitivity Analysis of the Strength of the Work Test in the Base Case

	Change in Retirement Age (Years)	
	Work Test Fully Binding	Work Test Not Binding for 40%
Removal of the work test	2.4	1.4
Actuarial Adjustment	0.4	0.4
Removal of the work test and:		
- Actuarial adjustment	2.7	1.7
- Pay CPP premium until retirement	1.2	0.3

V. Conclusions

In this paper we used a simulation model to answer the question of whether small changes to the CPP could induce individuals to delay retirement. We find that the work test—the requirement of a job separation in order to take-up CPP benefits—distorts the post-retirement price of leisure, and induces individuals to retire earlier than they otherwise would. In the simulation model, we are able to reproduce quite closely the current income-related retirement patterns—60 for lower income groups and about 62 for the high-income groups. When we remove the work test requirement, individuals remain in the labour force for as many as about 4 years longer than in the base case for high-income individuals and by about 2 years for lower income individuals. This result still holds even if we change the actuarial adjustment, making early CPP take-up less generous. Within this model, the removal of the work test will increase the labour force participation of those around the traditional retirement age.

As discussed in the previous section, the results were based on the assumption that individuals may not return to work after retiring claiming CPP. However, in practice, the work test requirement in the CPP only requires that there be a separation from work individuals may subsequently return to the labour market if they wish. Using available data, we find that a significant number of early retirees appear to be unaffected by the work test—as many as 30 to 50 per cent. While the sensitivity analysis suggests that the impact of eliminating the work test depends on the strength of the work test in the base case, the results still suggest it still has the largest impact on retirement ages of all the alternatives, under each of our assumptions for the strength of the work test in the base case.

The impact of each of the policy changes on the financial status of the plan is unclear since both total contributions and retirement benefits could be affected in the long run following any of the changes. Furthermore, alterations to the CPP will have an indirect impact on the general fiscal balance due to the fact that CPP contributions are non-taxable, and benefits count as income when calculating the GIS claw-back. As a result, reductions in CPP benefits will translate into increases in GIS benefits for individuals in the relevant income range.

Further work would be necessary to quantify the overall effect on the general fiscal position as well as on the financial status of the plan. For example, a complete projection of the CPP account would take all types of expenditure—such as disability and spousal benefits—into account. A macro-simulation model built specifically to project the financial status of both the CPP account and the federal and provincial debt and primary balances should be used to estimate the financial costs and benefits of each of the policy changes considered in this paper.

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VII. Appendix 1

Table A1: CPP Claim Age

	(I)	(II)	(III)	(IV)	(V)	Weighted Average
Peak Earnings (Age 53)	$16,445	$37,148	$57,840	$78,533	$99,226	
Earnings Growth to Peak	0.50%	2.23%	2.96%	3.38%	3.65%	
Base Case	60	61	61	61	62	60.94
Base Case--No Work Test	60	60	60	60	60	60.00
Actuarial Adjustment	60	61	62	62	62	61.37
Actuarial --No Work Test	60	60	60	60	60	60.00
Pay Premium until Retirement	60	61	61	61	62	60.94
Premium to Retire--No work test	60	61	61	61	61	60.85
Premium to Retire, No work test, Actuarial	60	61	61	62	62	61.11

VIII. Appendix 2

Table A2: 30 per cent Unaffected by the Work Test

	(I)	(II)	(III)	(IV)	(V)	Weighted Average
Peak Earnings (Age 53)	**$16,445**	**$37,148**	**$57,840**	**$78,533**	**$99,226**	
Earnings Growth to Peak	0.50%	2.23%	2.96%	3.38%	3.65%	
Base Case	60	61.6	61.9	62.2	62.9	61.660
Base Case—No Work Test	60	63	64	65	65	63.330
Actuarial Adjustment	60	61.6	62.9	62.9	62.9	62.039
Actuarial –No Work Test	60	63	65	65	65	63.592
Pay Premium until Retirement	60	61	61.6	61.9	62.6	61.309
Premium to Retire—No Work test	60	61	63	64	64	62.161
Premium to Retire, No Work test, Actuarial	60	61	63	64	64	62.161

Table A3: 40 per cent Unaffected by the Work Test

	(I)	(II)	(III)	(IV)	(V)	Weighted Average
Peak Earnings (Age 53)	**$16,445**	**$37,148**	**$57,840**	**$78,533**	**$99,226**	
Earnings Growth to Peak	0.50%	2.23%	2.96%	3.38%	3.65%	
Base Case	60	61.8	62.2	62.6	63.2	61.899
Base Case—No Work Test	60	63	64	65	65	63.330
Actuarial Adjustment	60	61.8	63.2	63.2	63.2	62.261
Actuarial –No Work Test	60	63	65	65	65	63.592
Pay Premium until Retirement	60	61	61.8	62.2	62.8	61.431
Premium to Retire—No Work test	60	61	63	64	64	62.161
Premium to Retire, No Work test, Actuarial	60	61	63	64	64	62.161

Table A4: 50 per cent Unaffected by the Work Test

	(I)	(II)	(III)	(IV)	(V)	Weighted Average
Peak Earnings (Age 53)	$16,445	$37,148	$57,840	$78,533	$99,226	
Earnings Growth to Peak	0.50%	2.23%	2.96%	3.38%	3.65%	
Base Case	60	62	62.5	63	63.5	62.137
Base Case—No Work Test	60	63	64	65	65	63.330
Actuarial Adjustment	60	62	63.5	63.5	63.5	62.483
Actuarial –No Work Test	60	63	65	65	65	63.592
Pay Premium until Retirement	60	61	62	62.5	63	61.553
Premium to Retire—No Work test	60	61	63	64	64	62.161
Premium to Retire, No Work test, Actuarial	60	61	63	64	64	62.161